Instruction Handbook for....

ME- 1063

AIL Type 74

AUTOMATIC NOISE-FIGURE INDICATOR

SERIAL NO. 600 AND ABOVE ONLY

September 1961

CUTLER-HAMMER

AIRBORNE INSTRUMENTS LABORATORY
DEER PARK, LONG ISLAND, NEW YORK

CONTROL AIL DIVISION

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INSTRUCTION HANDBOOK FOR
AIL TYPE 74
AUTOMATIC NOISE-FIGURE INDICATOR

Part Numbers

07410
07403
07404
07406

September 1961

AIRBORNE INSTRUMENTS LABORATORY
A DIVISION OF CUTLER-HAMMER, INC.
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TABLE OF CONTENTS

		Page
I.	General Description	1
	A. Purpose and Applications	1
	B. Specifications	1
	C. Description of Equipment	2
II.	Theory of Operation	5
	A. General	5
	B. Noise Generators	6
	C. Y-Factor	7
	D. Noise-Lamp Modulator	9
	E. Circuit Description	9
III.	Operation	13
	A. Interconnections	13
	B. Automatic Noise-Figure Measurement	13
	C. Manual Noise-Figure Measurement	14
	D. Checks and Adjustments	15
	E. Precautions	19
IV.	Maintenance Instructions	21
	A. Visual Inspection	21
	B. Power Supply	21
	C. Multivibrator and Modulator	22
	D. Automatic Gain Control (AGC)	23
	E. Video Amplifier and Synchronous Detector	23
	F. IF Amplifier	23
	G. Meter Calibration	23
	H. Noise Generator	26
	I. Replaceable Parts	26
	J. Noise Diode	26
Appendix A--Operating Instructions for Type 07404 Tunable IF Amplifier		A-1
Appendix B--Increased Frequency Range of Type 07404 Tunable ANFI		B-1

LIST OF ILLUSTRATIONS

Figure	
1	Y-Factor vs Noise Figure for 15.28-db Noise Source
2	Automatic Noise-Figure Indicator, Functional Block Diagram
3	Automatic Noise-Figure Indicator, Schematic Diagram
4	30-Mc IF Amplifier of Automatic Noise-Figure Indicator, Schematic Diagram
5	60-Mc IF Amplifier of Automatic Noise-Figure Indicator, Schematic Diagram
6	Typical Bench Setup Using Automatic Noise-Figure Indicator and Noise Generator for Automatic Noise-Figure Measurement
7	Bench Setup for Manual Noise-Figure Measurement
8	Noise Diode Current vs Noise Figure
9	Fired Insertion Loss vs Reduction in Excess Noise Power Output
10	Noise Diode, Schematic Diagram
A-1	IF Converter 07404, Schematic Diagram

LIST OF TABLES

Table		Page
I	Arrangement of Switching System	11
II	Noise Tube Current and Replacement Data	17
III	IF Amplifier Alignment, 30 and 60 Mc	24
IV	IF Amplifier, DC Voltage Chart, 30 and 60 Mc	25
V	Automatic Noise-Figure Indicator, DC Voltage Chart	27
VI	IF Amplifier, Resistance Chart, 30 and 60 Mc	28
VII	Automatic Noise-Figure Indicator, Resistance Chart	29
VIII	Waveforms	30
IX	List of Replaceable Parts	31
A-I	Tunable IF Amplifier, DC Voltage Chart	A-3
A-II	Tunable IF Amplifier, Resistance Chart	A-3
A-III	List of Replaceable Parts	A-4

I. GENERAL DESCRIPTION

A. PURPOSE AND APPLICATIONS

The AIL Type 74 Automatic Noise-Figure Indicator (ANFI) is intended primarily for the automatic monitoring of noise figures of receivers, tuners, and other equipment during actual operation. The effects of adjustments and modifications of the equipment under test can thus be immediately observed. The instrument is completely automatic and requires no auxiliary equipment or interpolations for operation.

Another important application of the ANFI is its use as a precision receiver for relative-gain measurements. With the addition of a calibrated IF attenuator, quick measurements of power-level differences up to 65 db can be made.

B. SPECIFICATIONS

Noise-figure range	Low scale 0 to 25 db High scale 23 to 36 db, calibrated with extension to infinity
RF range	12 Mc to 40 kMc
Accuracy	Low scale $\pm$0.5 db High scale $\pm$1.0 db
Input sensitivity (noise generator off)	50 μv into 50 ohms at 30 Mc* 100 μv into 50 ohms at 60 Mc 100 μv into 50 ohms at 40 to 180 Mc

* The AGC circuits will regulate receiver gain down to a CW input of 50 μv at the IF center frequency. An equivalent amount of noise must be supplied to the IF input of the ANFI to maintain its calibration.

Dynamic range (AGC)	Greater than 65 db
Intermediate frequency	30 or 60 Mc standard
Bandwidth	6.0 Mc minimum--30 and 60 Mc center frequency 2.0 Mc minimum--40 to 180 Mc center frequency
Power output	Sufficient to operate all AIL noise sources in both automatic and manual modes
Meter function	Noise figure (two ranges), second-detector current, noise-tube current
IF gain control	Available for manual operation
Recorder output for noise figure	0.05 volt DC across 10,000 ohms
AGC output	-2 to -6 volts DC
Input power	110 volts AC, 60 cps
Overall dimensions	19 inches wide by 8-3/4 inches high by 14 inches deep
Net weight	60 lb
Shipping weight	75 lb

C. DESCRIPTION OF EQUIPMENT

The complete equipment can be divided functionally into two main units: the noise source (consisting of the appropriate argon discharge lamp and/or noise diode, a low-frequency oscillator, and a square-wave modulator), and the noise-figure measuring equipment (consisting of a gain-controlled IF amplifier, video detector, video amplifier, synchronous detector, and indicating meter). The noise genera-

tor is coupled to the receiver or other piece of equipment under test. The IF output of the equipment under test feeds the IF amplifier of the ANFI. The square-wave modulated noise signal in the ANFI is amplified in a gain-controlled IF amplifier, detected, further amplified in video stages, detected in a synchronous detector, and fed into a differential cathode-follower meter circuit calibrated directly in decibels of noise figure.

II. THEORY OF OPERATION

A. GENERAL

The noise figure of a network is defined as the ratio of the available input-to-output signal-to-noise power ratios:

$$F = \frac{S_i/N_i}{S_o/N_o} \qquad (1)$$

where

F = the noise figure
S_i = the available signal input power
N_i = the available noise input power
S_o = the available signal output power
N_o = the available noise output power

Equation 1 implies that for an ideal (noiseless) network--where the signal-to-noise ratio is not degraded--$S_o/N_o = S_i/N_i$ and $F = 1$ (or 0-db noise figure). In actual cases, however, S_o/N_o is smaller than S_i/N_i because of the noise generated in the network. Using a standard noise source, S_i/N_i is known. Furthermore, the noise output of a receiver of available gain G can be written as

$$N_o = G(N_i + N_r)$$

where

N_r = the equivalent internally-generated noise power referred to the input terminals

since

$$\frac{S_i}{S_o} = \frac{1}{G}$$

the noise-figure formula (equation 1) can be written as

$$F = \frac{1}{G} \times \frac{G(N_i + N_r)}{N_i} = 1 + \frac{N_r}{N_i} \qquad (2)$$

This is the basis for the noise-figure measurement system of the ANFI.

B. NOISE GENERATORS

1. GAS-DISCHARGE LAMP

Gas-discharge lamps are sources of noise power because of the random motions of the electrons when the gas is ionized. The term "noise temperature" is related to the mean electron velocity in the gas and is referred to 290 K.

Thus, the relative excess noise temperature of a gas-discharge lamp, referred to 290 K (T_o), can be written as

$$t_d - 1 = \frac{T_d - T_o}{T_o} = \frac{T_d}{T_o} - 1 \qquad (3)$$

where

T_o = the reference temperature, assumed to be 290 K
T_d = the discharge or ionized temperature

For a pure argon-discharge lamp, in which T_d is 10,100 K,

$$t_d - 1 = \frac{10,100}{290} - 1 = 33.8$$

The available relative excess noise power in decibels is therefore 10 log 33.8, or 15.28 db above thermal noise.

2. NOISE DIODE GENERATOR

The noise diode head uses a temperature-limited diode. It has a useful frequency range from 12 to 250 Mc.

The diode, a Sylvania Type 5722, is a tungsten filament tube designed for use as a noise generator in frequencies up to about 400 Mc. The determining factors for the frequency range of this tube are the mountings used, transit time loading, and internal resonance. Since the tube has a tungsten filament, the shot noise is a known function of the DC plate current if sufficient plate voltage is applied to obtain saturation. The excess noise generated is calculated by the equation

$$N_{db} = 10 \log 20IR \qquad (4)$$

where R is the generator termination in ohms, and I is the diode plate current in amperes.

For use with the Type 74 Automatic Noise-Figure Indicator, the excess noise from the generator is set at 15.3 db, the same as that obtained from the gas-discharge generators. A single meter calibration, therefore, can be used for all generators. This amount of noise, which is 15.3 db above thermal noise, is obtained by using 33.8 ma of noise current when the noise diode generator is terminated in 50 ohms. The ANFI has provisions for a scale expansion when using the noise diode. Two ranges of noise current (0 to 5 ma and 0 to 50 ma) are available by making the proper switch selection.

C. Y-FACTOR

In determining the noise figure of a network or system, it is neither easy nor convenient to measure the gener-

ated noise directly. A practicable indirect method is to make two power-output measurements for two different input conditions. The ratio of these two outputs, called the Y-factor, is related to the noise figure as follows:

$$F = \frac{\left(\frac{T_d}{T_o} - 1\right)\frac{B_o}{B} - Y\left(\frac{T_i}{T_o} - 1\right) - \left(\frac{B_o}{B} - 1\right)\left(\frac{T_i}{T_o} - 1\right)}{Y - 1} \qquad (5)$$

where

B_o = the overall noise bandwidth (including image, spurious, and other responses)

B = the useful-channel bandwidth

T_i = the temperature of the termination in the noise-off condition

Y = the ratio of power output with the generator on to the output with the generator off (equation 1)

Usually, T_i is about the same as T_o; if B_o equals B, equation 5 reduces to

$$F = \frac{T_d}{T_o} - \frac{1}{Y - 1} \text{ (in power ratio)} \qquad (6)$$

or

$$F_{db} = 10 \log\left(\frac{T_d}{T_o} - 1\right) - 10 \log(Y - 1) \qquad (7)$$

When extreme accuracy is desired, equation 5 must be used to take account of temperature variation, image response, etc. Figure 1 shows the values of F_{db} in terms of Y (from equation 7).

D. NOISE-LAMP MODULATOR

In an automatic noise-figure indicating system, a means must be provided to periodically shut off the noise generator. This is accomplished in the ANFI by the square-wave modulator. A 400-cps, variable-frequency, square-wave generator keys the noise lamp on and off. The output of the video detector consists of a square wave (as shown in Figure 2) whose maximum level corresponds to power output with the noise generator on, and whose minimum level corresponds to receiver noise alone (noise generator off). The peak-to-peak value of this square wave is therefore an indication of the noise figure of the network under test.

E. CIRCUIT DESCRIPTION

1. GAS-DISCHARGE LAMP

Figure 2 is a functional block diagram and Figures 3, 4, and 5 are schematic diagrams of the ANFI. A 400-cps multivibrator and its associated amplifier produce both positive and negative pulses for simultaneous triggering of shunt modulator V8, which ignites the gas tube, and series modulator V10, which opens or closes the noise-lamp circuit.

When the negative-going pulse is applied to the grid of V8, the tube cuts off. As a result of the high inductance in the plate circuit, an instantaneous potential of from 1800 to 2200 volts is developed, which is sufficient to ionize the argon lamp. With the triggering of the shunt tube, the positive-going pulse from the amplifier drives series modulator V10 into conduction. Tube V10 is a dual triode (type 6AS7GA) with both sections in parallel to ensure adequate current for the noise lamp. At the end of the negative-going pulse, V10 cuts off, thereby breaking the noise-lamp circuit. The noise output then decreases to zero, and V8 again conducts.

2. NOISE DIODE

The noise diode uses a Sylvania 5722. A 6AS7GA (V10) is used in the Type 74 as the modulator control tube for the noise diode. Series plate modulation of the noise diode is obtained by using square-wave modulating voltages from the plates of V6 and V7 (the multivibrator and multi-amplifier, respectively) on the grid of V10. The noise diode, which is in the cathode circuit of V10, is driven in and out of conduction from cutoff into saturation. Switching is required to operate the noise diode in the ANFI and manual modes. Two current noise ranges are provided for the diode (0 to 5 ma and 0 to 50 ma).

3. IF AND VIDEO AMPLIFIERS

The IF and video amplifiers are conventional circuits. The IF amplifier is stagger-tuned and has a pass band of 6 Mc. The IF gain of the peak-to-peak signal is automatically maintained constant by the AGC loop from the video detector to the first three stages. This enables calibration of the detector current for a gain check.

4. SWITCHING

The pushbutton switching arrangement of the ANFI has two dependent interlocked sets of buttons. The first set of buttons--MANUAL ON, MANUAL OFF, and AUTO NF ON--selects the mode of operation of the noise generator. The second set of buttons--NOISE GEN CURRENT, 2ND DET CURRENT, and NF RANGE HIGH and LOW--selects the indication presented on the meter.*

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* An additional rotary switch is provided to switch from the gas-discharge lamp to either range of the temperature-limited noise diode. The 0 to 5 ma range of noise diode current is used on manual Y-factor measurements only.

Table I lists the possible circuit and function arrangements for various button settings; however, the information given in Table I is not intended as an operating procedure.

TABLE I

ARRANGEMENT OF SWITCHING SYSTEM

Initial Adjustments	Noise Generator Pushbuttons Pressed	Meter Indication Pushbuttons Pressed	Adjustment
Multivibrator duty cycle and frequency	None	None	R50 for duty cycle and pps
Manual noise generator current	MANUAL ON	NOISE GEN CURRENT	R63 for appropriate current in each tube
Automatic noise generator current	AUTO NF ON	NOISE GEN CURRENT	R49 for one-half current in each tube
AGC level	AUTO NF ON	2ND DET	R13 for 0.5 ma
Zero	OFF	NF RANGE LOW	R40 for zero
High automatic noise figure	AUTO NF ON	NF RANGE HIGH	R30 for calibration
Low automatic noise figure	AUTO NF ON	NF RANGE LOW	R31 for calibration

III. OPERATION

A. INTERCONNECTIONS

Four simple steps are followed in setting up the ANFI for an automatic noise-figure measurement (Figure 6).

1. Connect the ANFI to a 115-volt, 60-cps power source (a minimum warm-up time of 15 minutes is recommended).
2. Connect the high- and low-voltage cables to the argon discharge noise generator, or plug in the noise diode head. Switch to the appropriate gas or diode generator.
3. Connect the output of the noise generator to the input of the receiver or other equipment to be tested (this includes proper termination of the noise generator).
4. Connect the IF output of the equipment under test to the IF input of the ANFI.

B. AUTOMATIC NOISE-FIGURE MEASUREMENT

Automatic measurement of noise figure is made in the following manner, using the noise generator and meter indication pushbuttons.

1. With the POWER switch in the ON position, allow the instrument to warm-up for about 15 minutes.
2. Press the noise generator AUTO NF ON and the meter indication 2ND DET CURRENT pushbuttons. Select either the gas or diode noise generator. The meter then reads the rectified second-detector current at the output of the IF amplifier. The meter should read 0.5 ma, indicating proper AGC action. (The AGC circuits will regulate receiver gain down to a CW input of 50 μv at the intermediate frequency.) An equivalent amount of noise must be applied to the IF input of the ANFI to maintain its calibration.

3. Press the noise generator AUTO NF ON and meter indication NF RANGE HIGH or LOW pushbuttons, and read the noise figure on the meter.

C. MANUAL NOISE-FIGURE MEASUREMENT

When a continuous monitoring of the noise figure of an instrument is not desirable (or when a single measurement of greater accuracy is desired), the ANFI can be used in conjunction with a calibrated IF precision attenuator for manual noise-figure measurements. Figure 7 shows the bench setup for such a measurement. A manual measurement of noise figure is made in the following manner.

1. ARGON-DISCHARGE NOISE GENERATOR

1. Interconnect the equipment as shown in Figure 7, and allow about 15 minutes for warm-up.
2. Rotate the noise generator switch to the GAS position.
3. Press the meter indication 2ND DET CURRENT and noise generator MANUAL OFF pushbuttons.
4. Adjust the MANUAL GAIN control for a convenient indication on the meter. If the equipment under test has a variable-gain preamplifier, it is desirable to set it at or near its maximum gain. Observe the reading on the meter.
5. Note the IF attenuator reading in db.
6. Press the noise generator MANUAL ON pushbutton. This action will inject the noise voltage into the system, and increase the meter deflection (an off-scale reading may result). Do not change the setting of the MANUAL GAIN control.
7. Increase the IF attenuation until the meter reading returns to the originally observed (no-noise) value. The difference between the attenuator settings in steps 5 and 7 is the Y-factor.
8. Using the Y-factor curve (Figure 1), obtain the actual noise figure of the equipment under test.

2. DIODE NOISE GENERATOR

1. Interconnect the equipment as shown in Figure 7 and allow about 15 minutes for warm-up. The 3-db method is utilized (a Y-factor of 2) when using the noise diode.
2. Rotate the noise generator GAS-DIODE switch to the DIODE position.
3. Press the noise generator MANUAL OFF and the meter indication 2ND DET CURRENT pushbuttons. Rotate the DIODE CURRENT ADJUST control fully counter-clockwise.
4. Adjust the IF GAIN control for a convenient indication on the current scale. Set the PRE-AMP GAIN control at or near maximum. Observe and note the reading on the meter.
5. Note the IF attenuator reading in db.
6. Increase the attenuator setting by 3 db, and press the noise generator MANUAL ON pushbutton.
7. Rotate the DIODE CURRENT ADJUST control in a clockwise direction until the indication on the CURRENT scale of the meter is the same as that observed in step 3.
8. Read the noise diode current on the meter.* The noise figure in db can now be obtained from the current-noise figure curve provided in Figure 8.

D. CHECKS AND ADJUSTMENTS

Both the automatic and the manual methods of noise-figure measurement with the noise generator and the ANFI are based upon predetermined and preset operating characteristics of these equipments. It is therefore desirable to make the following checks and adjustments of these characteristics at periodic intervals.

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* Low noise figures can better be read by using the 0 to 5 ma range on the noise generator GAS-DIODE switch.

1. MULTIVIBRATOR ADJUSTMENT

Potentiometer R50 independently controls the frequency of operation and duty cycle of the multivibrator. Varying potentiometer R50 will change the frequency of operation and the duty cycle. To change the frequency of operation and retain a 50-percent duty cycle, potentiometer R50 must be adjusted by observing the multivibrator waveform at test point 5.

The duty-cycle adjustment is made only once when initially checking out the instrument.

2. MODULATOR TRIGGER ADJUSTMENT

Potentiometer R57 is adjusted to sustain automatic operation of the gas noise generator. When properly adjusted, the leading edge of the current pulse (as viewed at test point 8) will have a slight overshoot. This overshoot not only ensures proper firing of the gas noise generator but also provides a quenching impulse that aids in the de-ionization.

3. NOISE-GENERATOR CURRENT

a. MANUAL

The gas lamps used in the noise generator are calibrated for various nominal currents listed in Table II. For each lamp a ±10 percent deviation from the calibrated current will not affect the noise output by more than 0.1 db. For precise measurements, however, it is desirable to set this current to the exact nominal current for each lamp. To obtain an indication of gas-lamp current, press the noise generator MANUAL ON and meter indication NOISE GEN CURRENT pushbuttons. Lamp current can be adjusted by turning potentiometer R63, located on the rear of the chassis. An additional noise current setting can be obtained by using the slide wire resistor under the chassis.

TABLE II

NOISE TUBE CURRENT AND REPLACEMENT DATA

AIL Type to Noise Generator	Frequency Range (kMc)	Noise Tube Current (ma)	Noise Tube AIL P/N
07010	0.2 to 2.6	175	113676
07048	2.6 to 3.95	200	116898
07049	3.95 to 5.85	200	113827
07050	5.85 to 8.20	175	116613
07051	7.05 to 10.0	175	116843
07052	8.2 to 12.4	175	116843
07091	12.0 to 18.0	175	112434
07053	18.0 to 26.5	175	112434
07096	26.0 to 40.0	100	114410

b. AUTOMATIC

Press the noise generator AUTO NF ON pushbutton, and adjust potentiometer R49 (located on the modulator board) for half the reading obtained when in manual operation. In automatic operation, the gas-lamp current is one-half the peak current through the gas lamp, because of the modulated mode of operation. The noise diode current in automatic operation may not always be half of that obtained in manual operation.

4. AGC LEVEL ADJUSTMENT

Since the meter calibration is based upon a constant voltage-level output from the IF amplifier, AGC is provided. To obtain AGC, press the noise generator AUTO NF ON and meter indication 2ND DET CURRENT pushbuttons, and adjust R13 for 0.5 ma.

5. METER CALIBRATION

Meter calibration potentiometers R30 and R31 correct variations in video-amplifier gain and variations due to aging, tube-component replacement, etc. This adjustment may have to be made periodically, depending upon the conditions under which the equipment is used. When the noise figure of the system under test has been determined by the manual Y-factor method, potentiometer R31 is adjusted in automatic operation to indicate the noise figure directly on the meter. The high noise-figure range is calibrated by inserting an accurate attenuator between the noise generator and the system under test. Potentiometer R30 is then adjusted for a meter indication of the original noise figure plus the attenuator loss.

6. DETECTOR CURRENT WITH AGC OFF

When manual noise-figure measurements are made, the AGC is removed by pressing the noise generator MANUAL ON or OFF pushbutton. The IF gain is then adjusted manually, and the reference reading is noted on the 0 to 0.5 ma scale when the meter indication 2ND DET CURRENT pushbutton is pressed.

7. MANUAL GAIN

This adjustment is effective only when the noise generator MANUAL ON or OFF pushbutton is pressed and is used for the manual noise-figure measurement. The IF gain is adjusted for a convenient reading on the meter scale, depending upon the gain of the equipment being tested.

8. ZERO ADJUSTMENT

Press the noise generator AUTO NF ON and meter indication LOW NF RANGE pushbuttons, and disconnect the IF input. Turn ZERO ADJ potentiometer R40 until the meter reads ∞.

E. PRECAUTIONS

In making noise-figure measurements, observe the following precautions to avoid measurement inaccuracies.

1. BANDWIDTH EFFECTS

In making a noise-figure measurement, the overall noise bandwidth (including image, spurious, and other responses) determines the actual noise figure of the equipment under test. Thus, the harmonic and spurious RF responses may make the indicated noise figure better than the actual value. For example, assuming the image response to be equal to the useful-signal response, the indicated noise figure will be 3 db better than the actual noise figure. To obtain the true noise figure of the equipment under test, the effect of spurious image responses must be accounted for properly (see equation 2).

2. GENERATOR TEMPERATURE

The noise-figure measurement outlined in paragraph C assumed that the argon gas-discharge generator temperature equals the temperature of the discharge. This is true if there is complete coupling of the noise output to the equipment under test. Any lesser coupling causes a reduction in the noise fed to the equipment under test. A measure of this coupling is the insertion loss of the fired generator. Using Figure 9, a correction to the final noise figure obtained can then be made.

3. NOISE-SOURCE TERMINATION

The accuracy of any noise-figure measurement depends upon the proper termination of the noise generator. The noise generator should be terminated with a 50-ohm load. The noise diode requires no termination.

4. TERMINATION TEMPERATURE

The effect of temperature variation of the noise-generator termination has little significance, except when making low noise-figure measurements of maximum accuracy. If the termination temperature (normally assumed to be about 290 K) changes appreciably because of prolonged use or other factors, a correction of the noise figure must be made.

5. Y-FACTOR MEASUREMENT

The Y-factor measurement should be made quickly to eliminate errors due to changes of the open loop gain of the receiver (no AGC).

IV. MAINTENANCE INSTRUCTIONS

A. VISUAL INSPECTION

A thorough visual inspection should be made of all components in the ANFI. This includes checking capacitors, chokes, and transformers for leakage and corrosion around contact points. Since the ANFI utilizes printed-circuit boards, an inspection system is required. A simple inspection method is to place a light behind the printed-circuit boards to make them transparent.

The visual inspection should also include inspection of the modulator cables. The cables should be tight in their receptacles, and the receptacles themselves should be checked for any loose components. In addition, the visual inspection should include a check of all the tubes in the ANFI.

B. POWER SUPPLY

Power-supply output voltages can be checked on the modulator printed-circuit board by measuring the voltages between test points 1, 2, and 3, and ground, with a noise tube fired. The measured voltages between test point 1 and ground is +350 volts DC unregulated. Test point 2 should yield +150 volts DC regulated, test point 3 should yield -150 volts DC regulated. Potentiometer R8 (located on the modulator printed-circuit board) is an adjustment for the +150 volt regulated supply. During maintenance, R8 should be adjusted to give +150 volts at test point 2.

C. MULTIVIBRATOR AND MODULATOR

The multivibrator operates at a nominal frequency of 400 cps (variable from 380 to 420 cps). Potentiometer R50, located on the modulator printed-circuit board, adjusts both the frequency and the duty cycle of the multivibrator. Test point 5 can be used to observe the waveforms on the plate of the multivibrator, and test point 6 can be used to observe the grid waveforms. The output of the multivibrator is fed into a squaring amplifier that drives the high-voltage modulator. The modulator section contains three separate adjustments, which have the following functions.

1. NOISE-TUBE CURRENT ADJUSTMENT

Potentiometer R63 adjusts the noise-generator current when the noise generator MANUAL ON pushbutton is pressed.

2. AUTO-CURRENT ADJUSTMENT

Potentiometer R49 varies the noise-generator current while the ANFI is operating in the automatic mode. It adjusts this current to one-half the CW noise-generator current (when using the gas-discharge generators).

3. MODULATOR TRIGGER ADJUSTMENT

Potentiometer R57 adjusts the modulator so that it will ensure firing of the noise generator each time the noise generator AUTO ON pushbutton is pressed.

WARNING

Use extreme care when testing the modulator section. Voltages of 2500 volts are present at the plate of V8 (6AU5). Do not attempt to measure this voltage unless proper precautions and adequate test equipment are used.

D. AUTOMATIC GAIN CONTROL (AGC)

AGC is provided to maintain a constant voltage level output from the IF amplifier. AGC level adjust potentiometer R13 is adjusted for a second-detector current of 0.5 ma, with an IF input level of 100 μv. This current should remain within ±5 percent over a 65-db IF input range.

E. VIDEO AMPLIFIER AND SYNCHRONOUS DETECTOR

Video amplifier V5 feeds a synchronous detector that obtains its synchronizing voltage from the cathode-follower output of amplifier V7. The presence of a video signal can be checked at test point 4. When the meter indication NF RANGE HIGH or LOW pushbutton is activated from the high to low noise-figure ranges, a change of about 17:1 in the video signal level should occur. The synchronizing voltage required to operate the detector circuit can be observed at test point 9. The detector output can be observed at test point 11.

F. IF AMPLIFIER

The maintenance of the IF amplifier is dependent upon the alignment and adjustment of the coils, as listed in Table III. To prevent AGC action during alignment, the noise generator OFF pushbutton should be pressed and IF gain control R20 should be advanced to indicate -2.75 volts DC at the AGC test point. Table IV lists the operating voltages for the IF amplifier when the noise generator MANUAL OFF pushbutton is pressed.

G. METER CALIBRATION

The meter-calibration controls are located on the front panel: R30 for the 23 to 36 db range and R31 for the 0 to 25 db range. As tubes are replaced and other components in the ANFI change because of aging, recalibration of the

TABLE III

30-MC IF AMPLIFIER ALIGNMENT

Coil Number	Frequency (Mc)
L1	31.0
L2	34.0
L3	26.0
L4	28.0
L5	34.0
L6	26.0
L7	33.0

60-MC IF AMPLIFIER ALIGNMENT

Coil Number	Frequency (Mc)
L1	61.5
L2	64.0
L3	55.5
L4	60.0
L5	64.0
L6	55.5
L7	60.0

TABLE IV

30-MC IF AMPLIFIER, DC VOLTAGE CHART

Tube	Tube Type	Pin 1	2	3	4	5	6	7
V1	6CB6	-2*	0.15			150	150	0.15
V2	6CB6	-2*	0.24			140	150	0.24
V3	6CB6	-2*	0.1			140	150	0.1
V4	6CB6	0	2.2			110	150	2.2
V5	6CB6	0	2.0			108	150	2.0
V6	6AN5	0	10.4			150	150	10.4

* Measured with tube out of circuit.

60-MC IF AMPLIFIER, DC VOLTAGE CHART

Tube	Tube Type	Pin 1	2	3	4	5	6	7
V1	6CB6	-2.1	0.56			120	150	0.56
V2	6CB6	-2.1	0.36			129	150	0.36
V3	6CB6	-2.1	0.68			128	150	0.68
V4	6CB6	0	2.4			113	150	2.4
V5	6CB6	0	2.2			102	150	2.2
V6	6AN5	0	12.0			150	150	12.0

Note:

1. All readings taken with a vacuum-tube voltmeter and given in volts, referenced to ground.
2. All readings taken with the IF input terminated in a 50-ohm load.
3. MANUAL GAIN control set to -2 volts at test point 10 with respect to ground.

meter circuit will be required. As noted in Section III, a Y-factor measurement should be made on both ranges. When an accurate measurement using the Y-factor method has been made, the unit is placed in automatic operation and meter-calibrating potentiometers R30 and R31 are adjusted according to the Y-factor noise-figure measurement.

H. NOISE GENERATOR

The noise generator should be checked at the contact ends for the corrosion, arcing, and poor contact between the noise-generator adapter connection and the noise-generator cables. Poor contact connections to the noise generator may result in poor ignition and transients from the noise generator. If the noise-generator tube becomes defective, replace it with the appropriate standard noise lamp as indicated in Table II.

Tables V through VII list voltage and resistance data, and Table VIII shows the waveforms that should be observed.

I. REPLACEABLE PARTS

Table IX is a list of replaceable parts.

J. NOISE DIODE

Figure 10 is a schematic diagram of the noise diode. Since the component arrangement is extremely critical, no attempt should be made to perform maintenance on the diode mount without adhering strictly to the physical layout of the components.

TABLE V

AUTOMATIC NOISE-FIGURE INDICATOR, DC VOLTAGE CHART

Tube	Tube Type	Pin 1	2	3	4	5	6	7	8	9
V1	6A57GTA	120	220	158	120	220	158	0	0	
V2	6AU6	-3.4	0	0	0	120	150	0	0	
V3	0A2	0	-150	-150	-150	0		-150		
V4	12AX7	90	-3.8	-2.8	0	0	150	0	-2.8	0
V5	12AU7	110	0	3.6	0	0	110	0	3.6	0
V6	12AT7	100	-21	0	0	0	90	-24	0	0
V7	12AT7	215	-35	4	0	0	150	-36	0	0
V8	6AU5GT	-2	0	8	0	200	0	0	150	
V9	6AU4GTA			270		255				
V10	6AS7GA	-138	180	0.5	-138	180	0.5	0	0	
V11	12AT7	150	-0.6	-0.80	0	0	150	0	1	0

Note:

1. All readings taken with a vacuum-tube voltmeter and given in volts, referenced to ground.
2. All readings taken with noise generator AUTO NF ON pushbutton pressed.

TABLE VI

30-MC IF AMPLIFIER, RESISTANCE CHART

Tube	Tube Type	Pin 1	2	3	4	5	6	7
V1	6CB6		39	0	0			39
V2	6CB6		47	0	0			47
V3	6CB6		47	0	0			47
V4	6CB6	0	180	0	0			180
V5	6CB6	0	180	0	0			180
V6	6AN5	0	680	0	0			680

60-MC IF AMPLIFIER, RESISTANCE CHART

Tube	Tube Type	Pin 1	2	3	4	5	6	7
V1	6CB6		39	0	0			39
V2	6CB6		47	0	0			47
V3	6CB6		47	0	0			47
V4	6CB6	0	180	0	0			180
V5	6CB6	0	180	0	0			180
V6	6AN5	0	680	0	0			680

Note:

1. All readings given in ohms with respect to ground.
2. POWER toggle switch in OFF position.

TABLE VII

AUTOMATIC NOISE-FIGURE INDICATOR, RESISTANCE CHART

Tube	Tube Type	Pin 1	2	3	4	5	6	7	8	9
V1	6A57GTA			190 k			190 k			
V2	6AU6	110 k	0	0	0		190 k	0		
V3	0A2	0	7 k	7 k	7 k	0		7 k		
V4	12AX7	300 k	1.4 k	115 k	0	0	190 k	110 k	115 k	0
V5	12AU7	230 k	100 k	1 k	0	0	200 k	18 k	1 k	0
V6	12AT7	200 k	2 meg	0	0	0	200 k	2 meg	0	0
V7	12AT7	510 k	1.1 meg	3 k	0	0	190 k	1.1 meg	10	0
V8	6AU5GT	300 k	0	100				0		
V9	6AU4GTA									
V10	6AS7GA	1 meg	∞	10	1 meg	∞	10	0	0	
V11	12AT7	190 k	10 k	32 k	0	0	190 k	0	30 k	0

Note:

1. All readings given in ohms with respect to ground.
2. All readings taken with noise generator AUTO NF ON pushbutton pressed. (This is the only pushbutton pressed during resistance readings of the ANFI.)
3. POWER toggle switch in OFF position.

TABLE VIII. WAVEFORMS

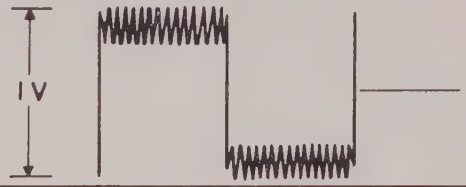
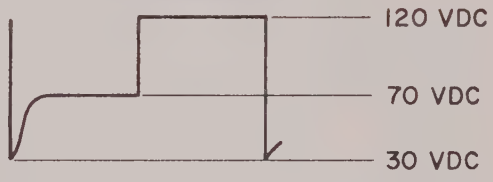
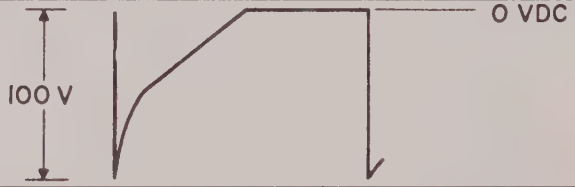
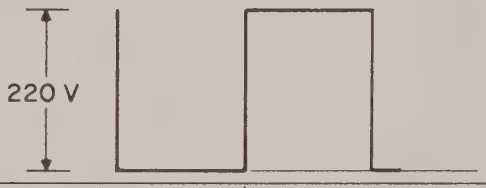
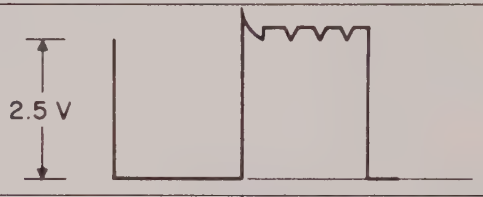
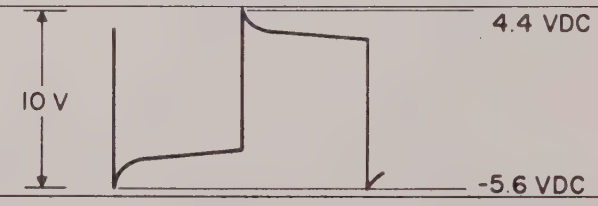
TEST POINT	DC VOLTAGE	WAVEFORM
TP1	350	NOT APPLICABLE
TP2	150	NOT APPLICABLE
TP3	-150	NOT APPLICABLE
TP4	-0.2	 FREQUENCY = 400 CPS
TP5	117	 FREQUENCY = 400 CPS
TP6	-17	 FREQUENCY = 400 CPS
TP7		 FREQUENCY = 400 CPS
TP8	1.3	
TP9	0	
TP10	-3.2	NOT APPLICABLE
TP11	-0.6	NOT APPLICABLE

TABLE IX

LIST OF REPLACEABLE PARTS

30-MC IF AMPLIFIER (Part No. 07403)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
C1	Capacitor, 715 μμf	Type 331 HIK	Erie
C3	Capacitor, 1000 μμf	S-114885	AIL
C4	Capacitor, 0.01 μf	Type 811-0.01	Erie Disc
C5 through C10	Same as C1		
C11	Capacitor, 51 μμf	N750K	Erie
C12 through C35	Same as C3		
C36 through C38	Same as C4		
CR1	Crystal diode	1N67	Raytheon or equivalent
L1	Inductor	112240	AIL
L2	Inductor	112239	AIL
L3	Same as L1		
L4	Inductor	113333	AIL
L5	Same as L2		
L6	Same as L4		
L7	Same as L4		
L8	Inductor, 14 μh	Yellow dot	Jeffers
L9 through L14	Same as L8		
L15	Inductor, 0.25 μh	Red dot	Jeffers
L16 through L20	Same as L15		

TABLE IX (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
R1	Resistor, composition, 4700 ohms ±5%, 1/2 w		Allen-Bradley
R2	Resistor, composition, 5100 ohms ±5%, 1/2 w		Allen-Bradley
R3	Same as R2		
R4	Resistor, composition, 2400 ohms ±5%, 1/2 w		Allen-Bradley
R5	Same as R2		
R6	Same as R2		
R7	Resistor, composition, 2700 ohms ±5%, 1/2 w		Allen-Bradley
R8	Resistor, composition, 6800 ohms ±5%, 1/2 w		Allen-Bradley
R9	Resistor, composition, 39 ohms ±5%, 1/2 w		Allen-Bradley
R10	Resistor, composition, 47 ohms ±5%, 1/2 w		Allen-Bradley
R11	Same as R10		
R12	Resistor, composition, 180 ohms ±5%, 1/2 w		Allen-Bradley
R13	Same as R12		
R14	Resistor, composition, 680 ohms ±5%, 1/2 w		Allen-Bradley
R15 through R19	Same as R12		
V1	Tube, electron	6CB6	RCA or equivalent
V2 through V5	Same as V1		
V6	Tube, electron	6AN5	RCA or equivalent

TABLE IX (cont)

60-MC IF AMPLIFIER (Part No. 07406)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
C1	Capacitor, 715 μμf	Type 331 HIK	Erie
C3	Capacitor, 1000 μμf	S-114885	AIL
C4	Capacitor	Type 811-.01	Erie Disc
C5 through C10	Same as C1		
C11	Capacitor, 68 μμf	N750K	Erie
C12 through C35	Same as C3		
C36 through C38	Same as C4		
CR1	Crystal diode	1N67	Raytheon or equivalent
L1	Inductor	113590	AIL
L2	Inductor	114999	AIL
L3	Same as L1		
L4	Inductor	112243	AIL
L5	Same as L4		
L6	Same as L4		
L7	Same as L1		
L8	Inductor, 1.1 μh	No dot	Jeffers
L9 through L14	Same as L8		
L15	Inductor 0.25 μh	Red dot	Jeffers
L16 through L20	Same as L15		

TABLE IX (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
R1	Resistor, composition, 4700 ohms ±5%, 1/2 w		Allen-Bradley
R2	Resistor, composition, 3900 ohms ±5%, 1/2 w		Allen-Bradley
R3	Same as R1		
R4	Resistor, composition, 2700 ohms ±5%, 1/2 w		Allen-Bradley
R5	Same as R2		
R6	Same as R1		
R7	Resistor, composition, 2700 ohms ±5%, 1/2 w		Allen-Bradley
R8	Resistor, composition, 6800 ohms ±5%, 1/2 w		Allen-Bradley
R9	Resistor, composition, 39 ohms ±5%, 1/2 w		Allen-Bradley
R10	Resistor, composition 47 ohms ±5%, 1/2 w		Allen-Bradley
R11	Same as R10		
R12	Resistor, composition, 180 ohms ±5%, 1/2 w		Allen-Bradley
R13	Same as R12		
R14	Resistor, composition, 680 ohms ±5%, 1/2 w		Allen-Bradley
R15 through R19	Same as R12		
V1	Tube, electron	6CB6	RCA or equivalent
V2 through V5	Same as V1		
V6	Tube, electron	6AN5	RCA or equivalent

TABLE IX (cont)

AUTOMATIC NOISE-FIGURE INDICATOR (Part No. 07410)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
C1	Capacitor, electrolytic, 100 μf, 500 vdc	TVL 1960	Sprague
C2	Capacitor, electrolytic, 40 μf, 450 vdc	TVL 1725	Sprague
C3	Capacitor, 0.5 μf, 200 vdc	BP-2-5	Astron
C4	Capacitor, 0.1 μf, 200 vdc	BP-2-1	Astron
C5	Same as C4		
C6	Capacitor, electrolytic, 2 μf, 50 v	SRE	Aerovox
C7	Same as C4		
C8	Same as C4		
C9	Capacitor, 51 μμf, 500 vdc	DM-15-S10	El Menco
C10	Capacitor, electrolytic, 4 μf, 150 v	TVA 1402	Sprague
C11	Capacitor, electrolytic, 50 μf, 25 v	BBR 50-25	Cornell-Dubilier
C12	Capacitor, 0.05 μf; 200 vdc	2TM-S5	Sprague
C13	Capacitor, electrolytic, 40 μf, 500 vdc	TVL 1950	Sprague
C14	Capacitor, 0.05 μf, 600 vdc	BP-6-0	Astron
C15	Capacitor, 0.002 μf, 200 vdc	6TM-D	Sprague
C16	Same as C15		
C17	Same as C4		
C18	Capacitor, mica, 2500 μμf, 3 kv	DD30252	Centralab

TABLE IX (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
C19	Capacitor, 2 μf, 50 v	SRE	Aerovox
C20	Capacitor, electrolytic, 40 μf, 150 vdc	TVA 1413	Sprague
C21	Same as C19		
C22	Capacitor, 0.05 μf, 600 vdc	6TM-S5	Sprague
CR1	Crystal diode	1N96	Hughes
CR2 through CR4	Same as CR1		
CR5	Silicon diode	1N208	Hoffman
CR6	Silicon rectifier	1N2071	Texas Instruments
CR7 through CR12	Same as CR6		
F1	Fuse, 6 amp	MTH-6	Buss
F2	Same as F1		
J1	Connector	126-222	Amphenol
J2	Not used		
J3	Connector, diode	165-36	Amphenol
L1	Inductor	C2991	Merrit
M1	Meter	B115442	AIL
R2	Resistor, composition, 300 k ±5%, 1 w		Allen-Bradley
R4	Resistor, composition, 100 k ±5%, 1/2 w		Allen-Bradley

TABLE IX (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
R5	Resistor, composition, 47 ohms ±5%, 1 w		Allen-Bradley
R7	Same as R4		
R8	Resistor, variable 25 k ±30%, 1/2 w	LH 61	Stackpole
R9	Same as R4		
R10	Resistor, wire-wound 2 k, 10 w	1-3/4 D-48-F	Ohmite
R12	Resistor, composition, 1.2 k ±5%, 1/2 w		Allen-Bradley
R13	Resistor, variable, 1 k ±30%, 1/2 w	LH 61	Stackpole
R14	Resistor, composition, 150 k ±5%, 1/2 w		Allen-Bradley
R15	Resistor, composition, 62 k ±5%, 1/2 w		Allen-Bradley
R16	Same as R4		
R17	Resistor, composition, 620 k ±5%, 1/2 w		Allen-Bradley
R18	Resistor, composition, 1 meg ±5%, 1/2 w		Allen-Bradley
R19	Resistor, composition, 3.9 k ±5%, 1/2 w		Allen-Bradley
R20	Resistor, variable, 5 k, 2 w	AB CU5021	Ohmite
R21	Resistor, composition, 300 k ±5%, 1/2 w		Allen-Bradley
R22	Resistor, composition, 56 k ±5%, 1/2 w		Allen-Bradley
R23	Resistor, composition, 2700 ohms ±5%, 1/2 w		Allen-Bradley

TABLE IX (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
R24	Same as R14		
R25	Same as R4		
R26	Resistor, composition, 10 k ±5%, 1 w		Allen-Bradley
R27	Resistor, composition, 1 k ±5%, 1/2 w		Allen-Bradley
R28	Same as R27		
R29	Same as R18		
R30	Resistor, variable, 5 k, 2 w	AB CLU5021	Ohmite
R31	Same as R30		
R32	Same as R26		
R33	Same as R27		
R34	Same as R6		
R35	Resistor, 3.9 k ±1%, 1/2 w	DCSH 1/2	Dalohm
R36	Same as R35		
R37	Same as R35		
R38	Same as R35		
R39	Same as R18		
R40	Resistor, variable, 1 k, 2 w	AB CLU1021	Ohmite
R41	Resistor, composition, 36 k ±5%, 1 w		Allen-Bradley
R42	Resistor, composition, 1 meg ±5%, 1/2 w		Allen-Bradley
R43	Resistor, composition, 22 k ±5%, 2 w		Allen-Bradley
R44	Resistor, composition, 100 k ±5%, 1 w		Allen-Bradley
R45	Resistor, composition, 3 k ±5%, 1/2 w		Allen-Bradley

TABLE IX (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
R46	Same as R4		
R47	Same as R42		
R48	Same as R41		
R49	Resistor, variable, 100 k ±30%, 1/2 w	LH61	Stackpole
R50	Resistor, variable, 1 meg ±30%, 1/2 w	LH61	Stackpole
R51	Resistor, composition, 1.3 meg ±5%, 1/2 w		Allen-Bradley
R52	Resistor, composition, 24 k ±5%, 1/2 w		Allen-Bradley
R53	Same as R52		
R54	Resistor, wire-wound, 5 k, 20 w	1 3/4-D-48-F	Ohmite
R55	Resistor, composition, 1.8 meg ±5%, 1/2 w		Allen-Bradley
R56	Resistor, composition, 10 k ±5%, 1/2 w		Allen-Bradley
R57	Resistor, variable, 100 k, 2 w	AB CLU1041	Ohmite
R58	Resistor, composition, 1 k ±5%, 1/2 w		Allen-Bradley
R59	Resistor, composition, 100 ohms ±5%, 1 w		Allen-Bradley
R60	Resistor, wire-wound, 2.5 k, 25 w	0208	Ohmite
R61	Resistor, wire-wound, 35 k, 10 w	1-3/4 D-54-F	Ohmite
R62	Resistor, wire-wound, 1000 ohms, 50 w	0405	Ohmite
R63	Resistor, variable, 750, 25 w	H-750-F2	Ohmite
R64	Resistor, composition, 10 ohms ±5%, 1 w		Allen-Bradley
R65	Resistor, composition, 10 k ±1%, 1/2 w	DCSH	Dalohm

TABLE IX (cont)

Reference Symbol	Name of Part and Description	Designation or Std. Type	Mfr.
R66	Same as R4		
R67	Resistor, composition, 300 k ±5%, 1/2 w		Allen-Bradley
R68	Resistor, composition, 18 k ±5%, 1/2 w		Allen-Bradley
R69	Same as R4		
R70	Resistor, composition, 470 ohms ±5%, 1/2 w		Allen-Bradley
R71	Resistor, composition, 100 ohms ±1%, 1/2 w	DCSH-1/2	Dalohm
R72	Resistor, variable, dual, 2 w; B, 20 ohms; A, 3 ohms	19195	Clarostat
R73	Resistor, variable, 1 ohm, 10 w	1 3/4-D-57-D	Ohmite
R74	Resistor, composition, 1 k ±1%, 1/2 w	DCSH-1/2	Dalohm
R75	Same as R56		
R76	Same as R42		
R77	Resistor, composition, 18 ohms ±5%, 2 w		Allen-Bradley
R78	Same as R42		
R79	Resistor, composition, 1 meg ±20%, 1 w	BAKW	RPC
R80	Same as R58		
R81	Resistor, composition, 150 ohms, 2 w		Allen-Bradley
R82	Same as R81		
R83	Same as R58		
R84	Same as R58		
S1	Switch, dpst	7590-L	Cutler-Hammer
S2	Switch, pushbutton Disconnect, Hi Volt Disconnect, Lo Volt	113270 115380 115069	AIL AIL AIL
S3	Switch	PA2031	Centralab

TABLE IX (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
T1	Transformer	R20A	Triad
T2	Transformer	PC8405	Stancor
T3	Transformer	A-20	UTC
T4	Transformer	20-02-015	SOLA
V1	Tube, electron	6AS7GTA	RCA or equivalent
V2	Tube, electron	6CB6A	RCA or equivalent
V3	Tube, electron	0A2	RCA or equivalent
V4	Tube, electron	12AX7	RCA or equivalent
V5	Tube, electron	12AU7	RCA or equivalent
V6	Tube, electron	12AT7	RCA or equivalent
V7	Same as V6		
V8	Tube, electron	6AU5GT	RCA or equivalent
V9	Tube, electron	6AU4GTA	RCA or equivalent
V10	Tube, electron	6AS7GA	Tung-Sol or equivalent
V11	Same as V6		

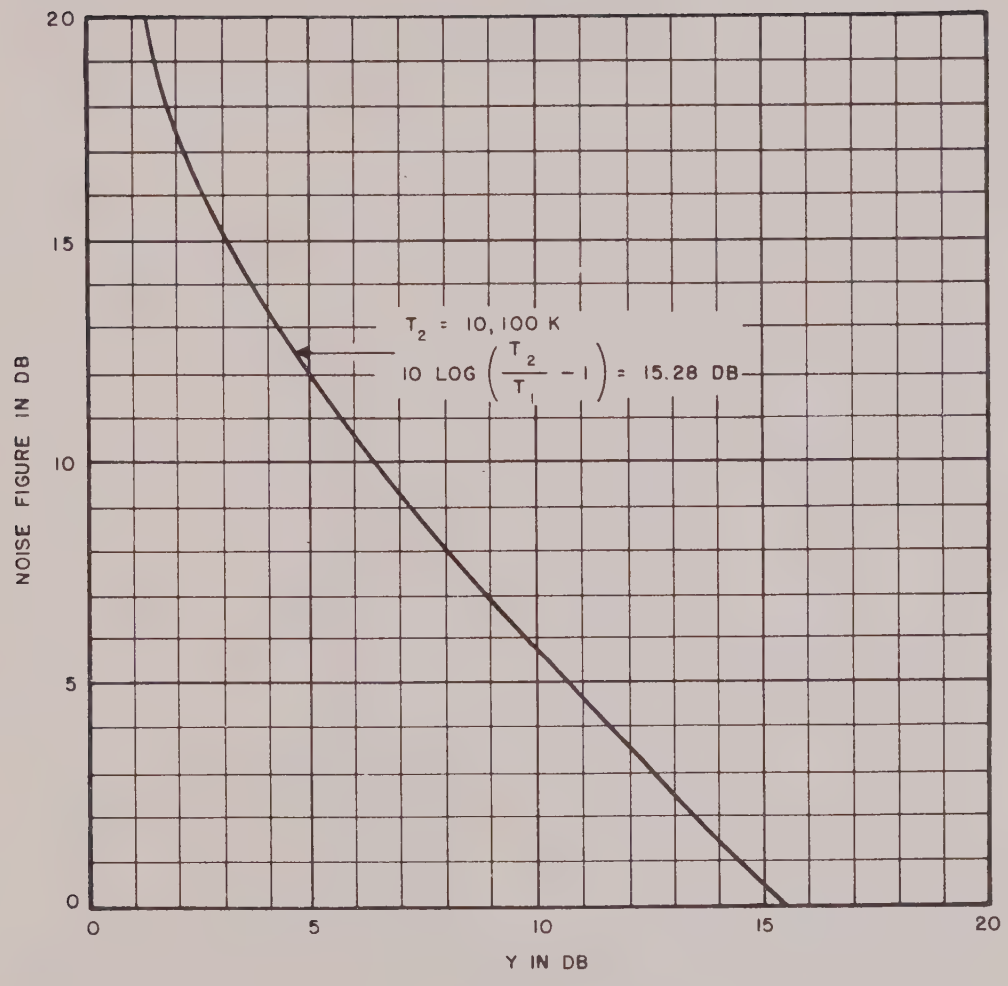


FIGURE 1. Y-FACTOR VS NOISE FIGURE FOR 15.28-DB NOISE SOURCE

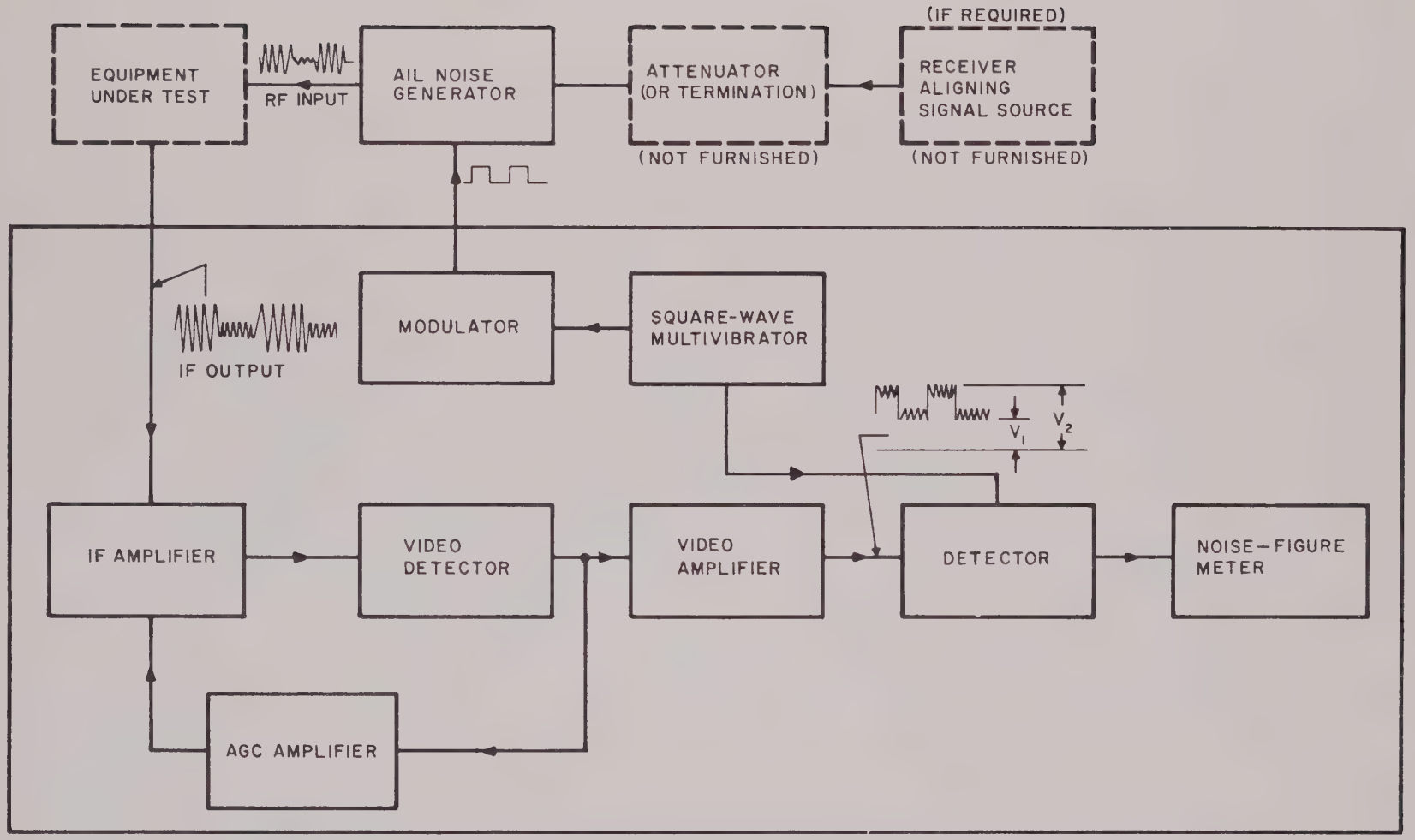


FIGURE 2. AUTOMATIC NOISE-FIGURE INDICATOR, FUNCTIONAL BLOCK DIAGRAM

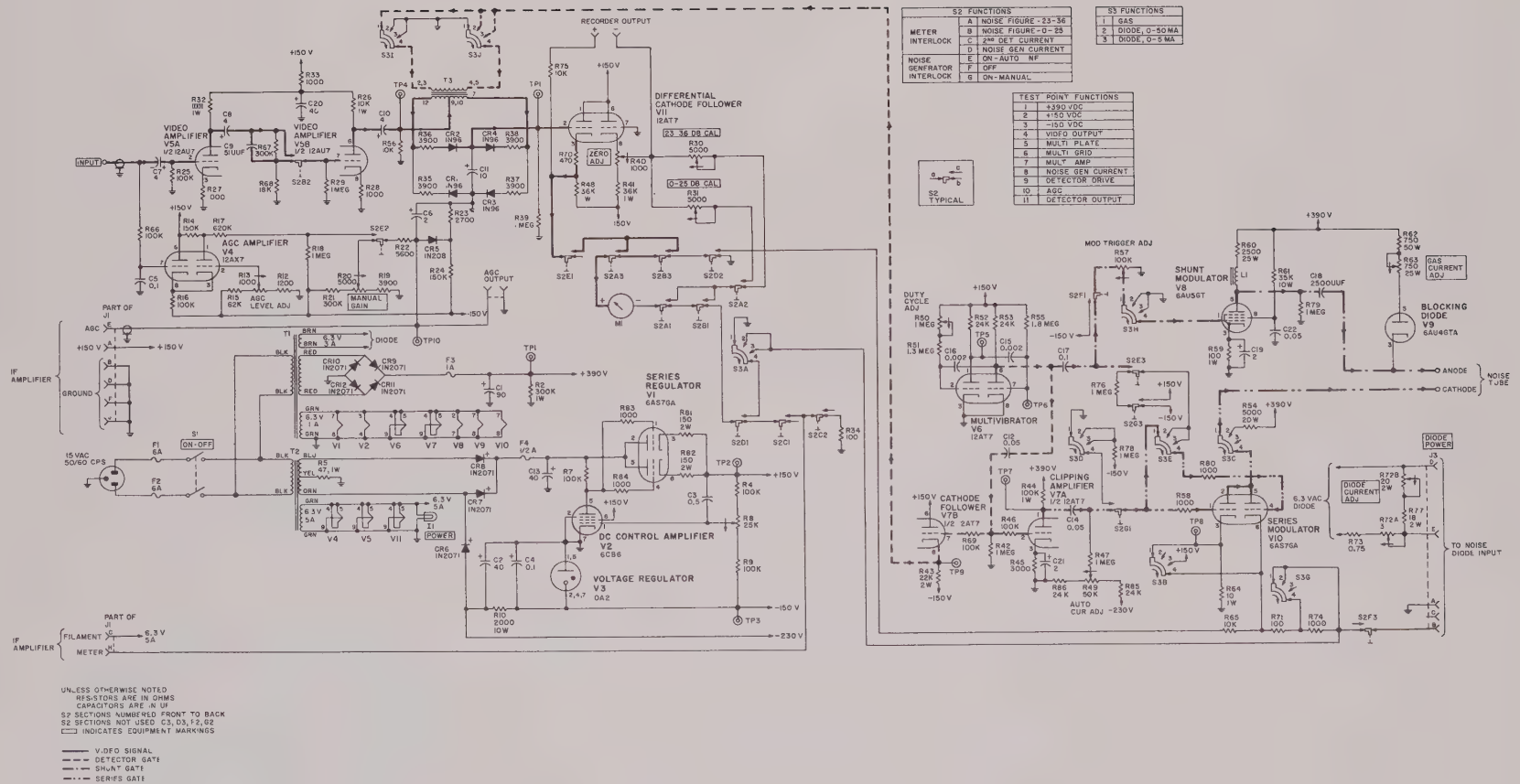
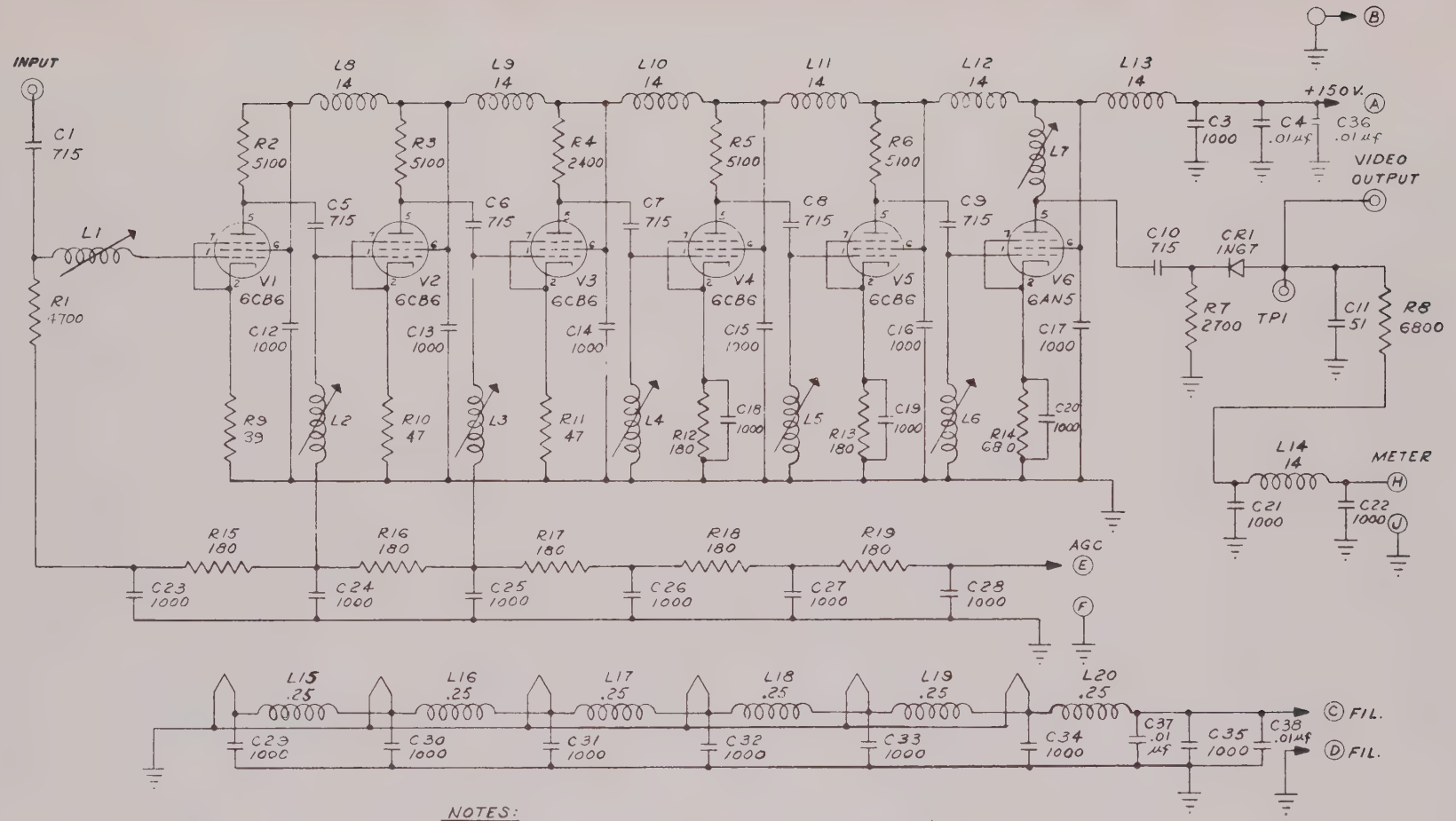


FIGURE 3. TYPE 74 AUTOMATIC NOISE-FIGURE INDICATOR, SCHEMATIC DIAGRAM

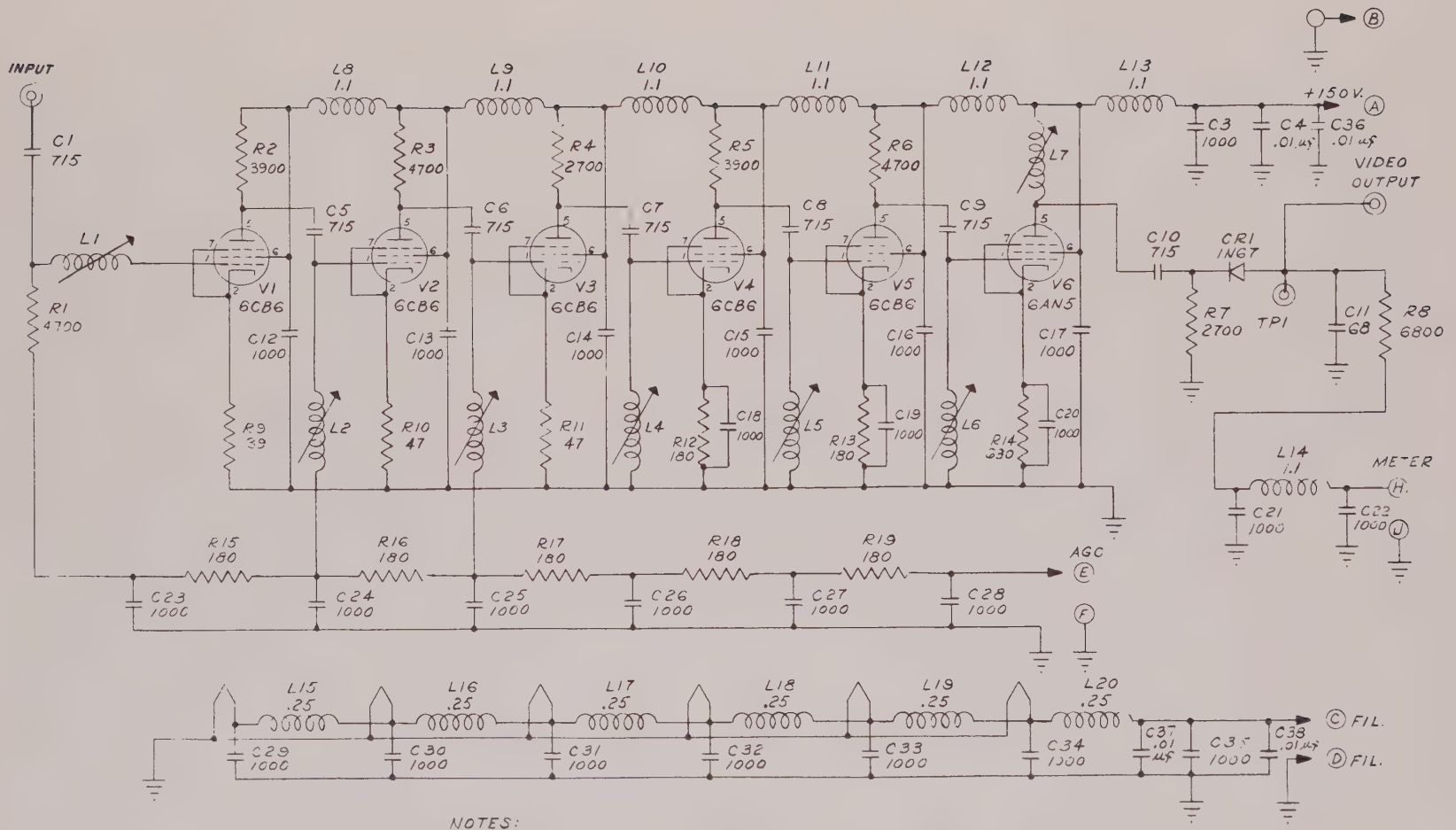


NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, ± 5% AND ALL CAPACITOR VALUES ARE IN UUF, ± 20% AND ALL COIL VALUES ARE IN UH UNLESS OTHERWISE SPECIFIED.
2. C2 NOT USED

COIL NO.	A.I.L. DWG. NO.	TUNING Mc
L1	112240	31
L2	112239	34
L3	112240	26
L4	113333	28
L5	112239	34
L6	113333	26
L7	113333	33

FIGURE 4. 30-MC IF AMPLIFIER OF AUTOMATIC NOISE-FIGURE INDICATOR, SCHEMATIC DIAGRAM



NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, ± 5% AND ALL CAPACITOR VALUES ARE IN UUF, ± 20% AND ALL COIL VALUES ARE IN UH UNLESS OTHERWISE SPECIFIED.
2. C2 NOT USED

FIGURE 5. 60-MC IF AMPLIFIER OF AUTOMATIC NOISE-FIGURE INDICATOR, SCHEMATIC DIAGRAM

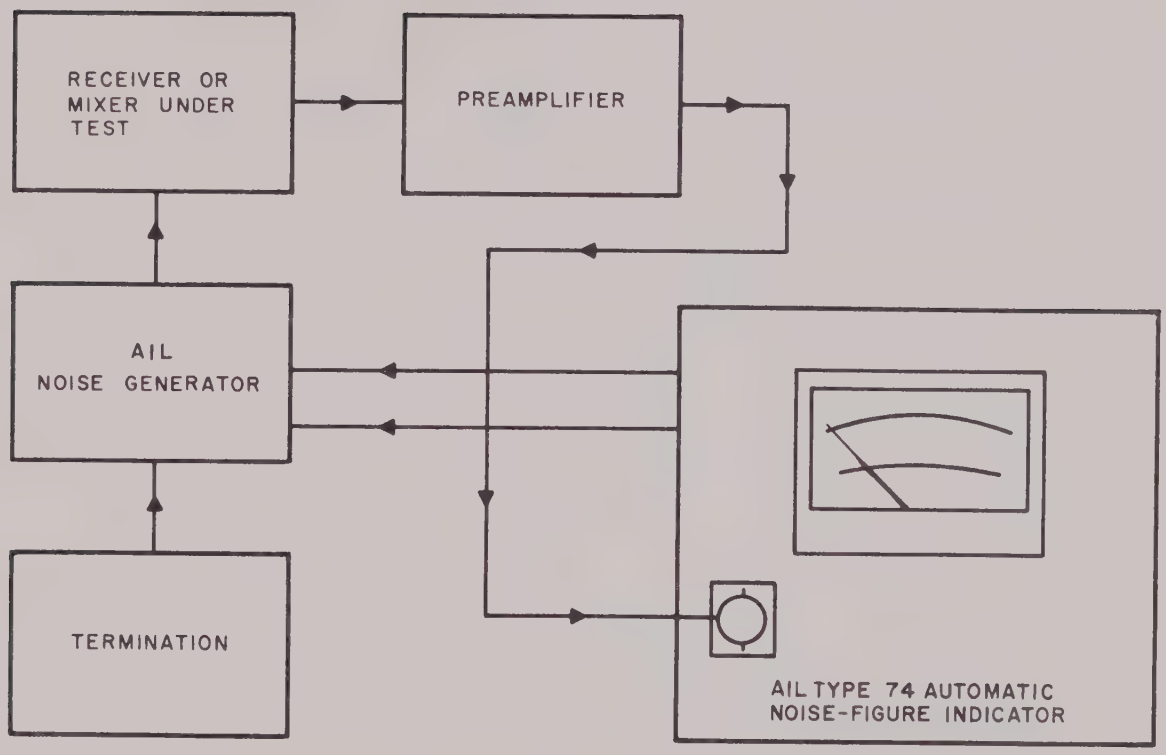


FIGURE 6. TYPICAL BENCH SETUP USING AUTOMATIC NOISE-FIGURE INDICATOR AND NOISE GENERATOR FOR AUTOMATIC NOISE-FIGURE MEASUREMENT

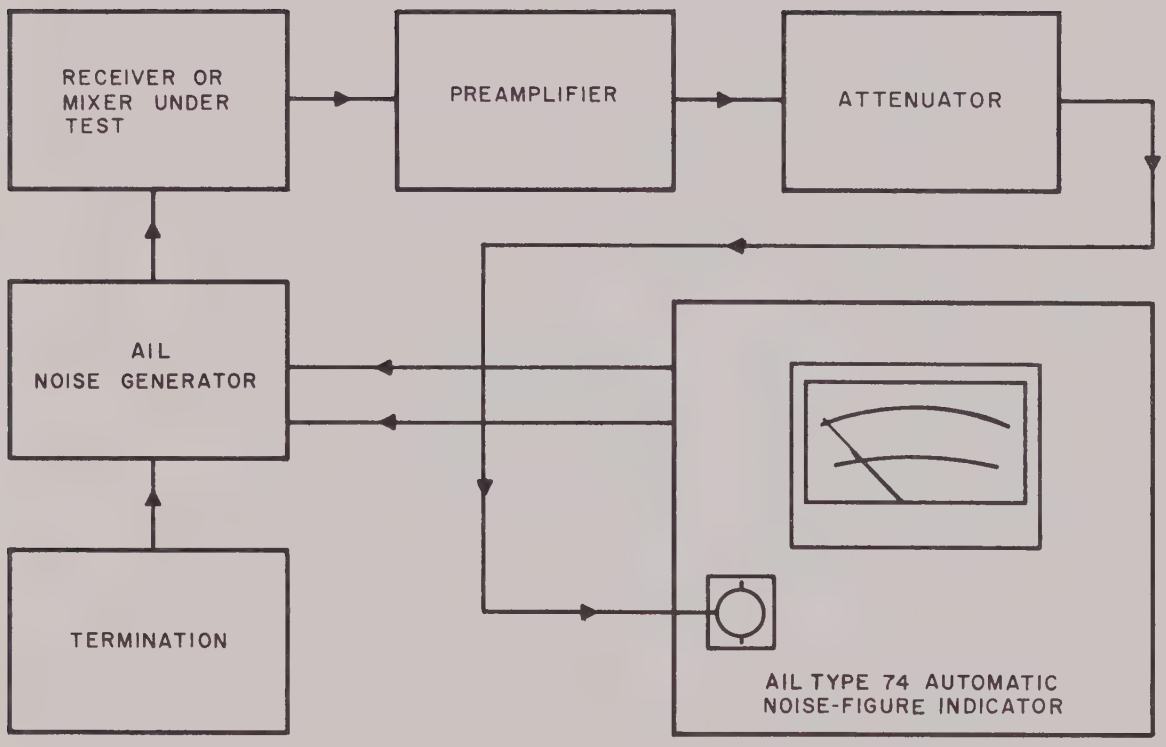


FIGURE 7. BENCH SETUP FOR MANUAL NOISE-FIGURE MEASUREMENT

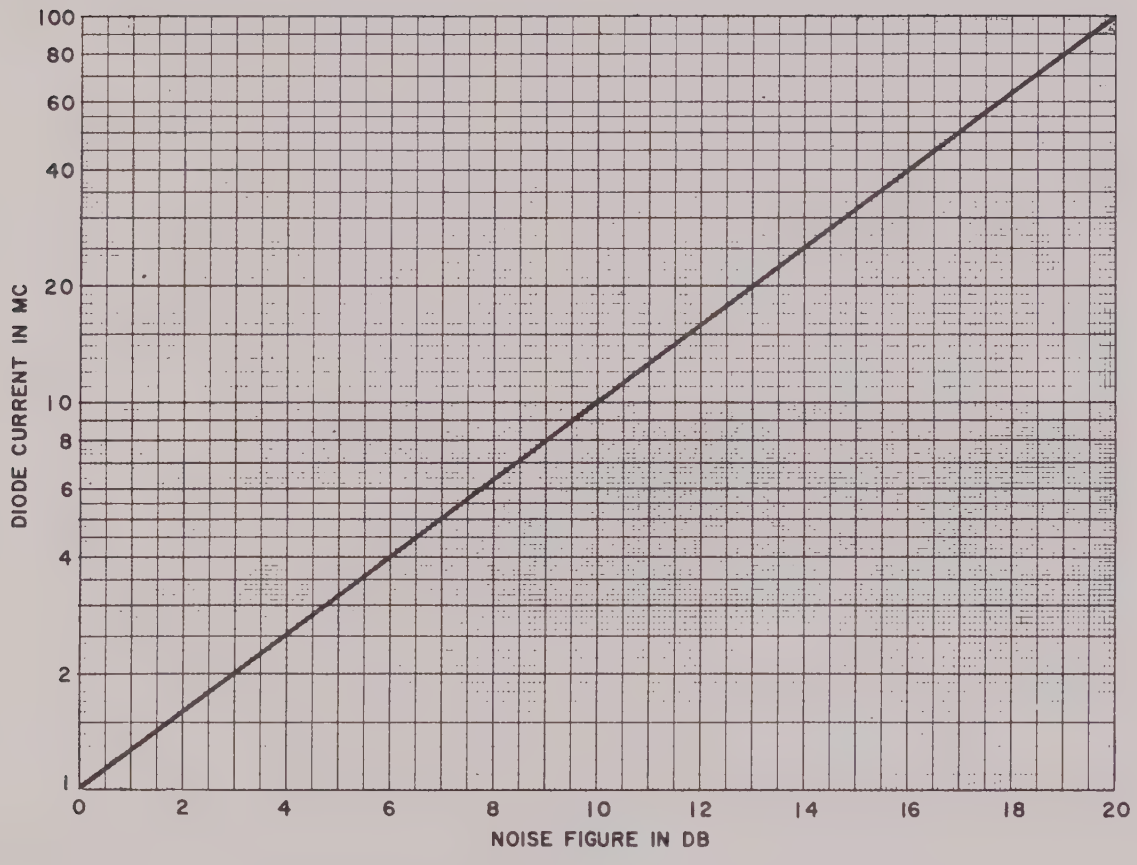


FIGURE 8. NOISE DIODE CURRENT VS NOISE FIGURE

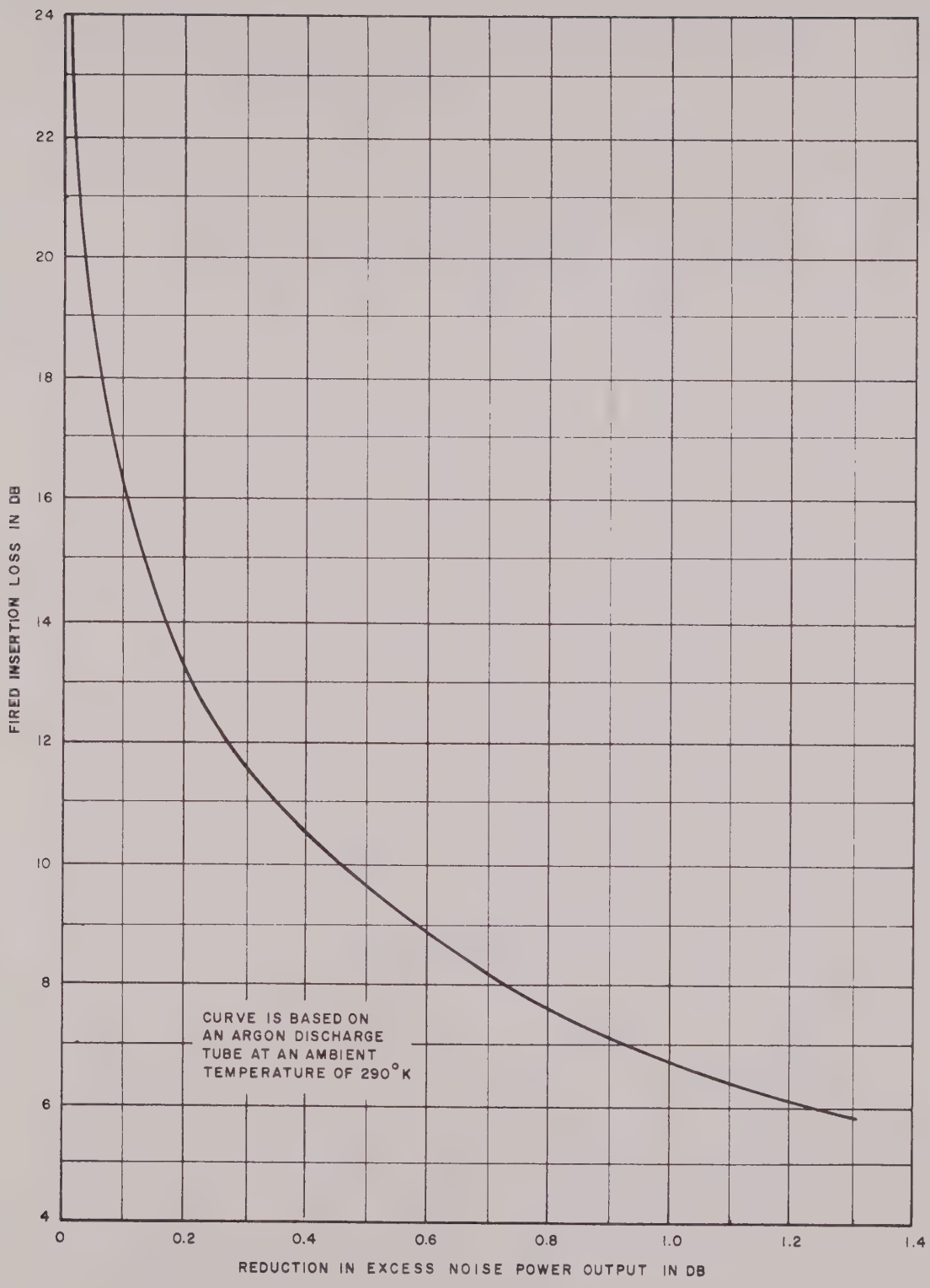
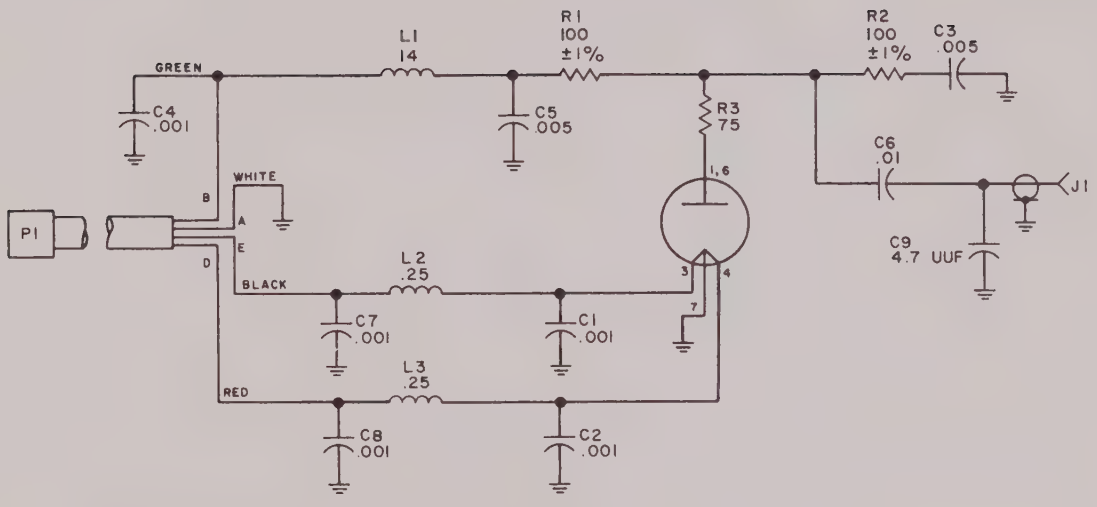


FIGURE 9. FIRED INSERTION LOSS VS REDUCTION IN EXCESS NOISE POWER OUTPUT



UNLESS OTHERWISE NOTED:
RESISTOR VALUES ARE GIVEN IN OHMS ±5%, 1/2 WATT
CAPACITOR VALUES ARE GIVEN IN UF
INDUCTOR VALUES ARE GIVEN IN UH

FIGURE 10. NOISE DIODE, SCHEMATIC DIAGRAM

APPENDIX A

OPERATING INSTRUCTIONS FOR TYPE 07404 TUNABLE IF AMPLIFIER

The Type 07404 Tunable IF Amplifier is interchangeable with any standard Type 74 IF amplifier strip. To effect this change, remove the Type 74 IF amplifier strip and install the Type 07404 IF amplifier as follows:

1. Disconnect AC power.
2. Loosen two thumb screws and remove top cover.
3. Unscrew four rubber-covered screws from bottom cover and remove cover.
4. Disconnect the cables from J1, J2, and J3 of the IF amplifier in the ANFI.
5. Remove the two hold-down screws underneath the ANFI chassis.
6. Remove the IF strip by sliding it back about 1 inch and lifting it out.
7. Install the Type 07404 IF amplifier by fastening it to the ANFI chassis with the two hold-down screws.
8. Connect the cables from J1, J2, and J3 of the IF amplifier.
9. Install bottom cover with four rubber-covered screws.
10. Install top cover and tighten two thumb screws.
11. Connect AC power.

The Type 07404 Tunable IF Amplifier is used in the same manner as described for the other IF amplifier in this handbook (see Figure A-1). It has the following additional features:

1. The IF strip will accept input frequencies of 30 Mc and from 40 to 180 Mc. Frequency changing is accomplished by inserting an insulated tuning tool into

the hole marked FREQ. ADJ. located on the front of the IF strip. After connecting the signal to the input connector, J1, marked 50 OHM and located on the front of the IF strip, the FREQ. ADJ. control can be tuned for a sharp maximum indication on the ANFI meter. At the time of this adjustment, the pushbutton meter switch should be in the 2ND DET position and the noise generator pushbutton should be in the OFF MANUAL position.

2. When the IF strip is used as a 30-Mc IF amplifier, care should be exercised to ensure that the internal local oscillator does not interfere with the sideband of the IF band pass. When the oscillator frequency is tuned to the lowest frequency, it may cause interference. Interference can be detected by disconnecting the signal input, tuning the FREQ. ADJ. control, and observing the residual current on the ANFI meter. Any increase in residual current indicates interference. It can be avoided by setting the FREQ. ADJ. control at a higher frequency.

1. SPECIFICATIONS

Input: 30 Mc, and from 40 to 180 Mc

Bandwidth: 2 Mc minimum

Sensitivity: 100 μv into 50 ohms

2. ALIGNMENT

These IF amplifiers are tested at the factory and should not require alignment during the life of the tubes. If it is not convenient to return the IF amplifier to the factory for service, the following table will be helpful:

Coil Number	Frequency (Mc)
L1	Tune to cover the oscillator range of 70 to 150 Mc
L2	30.0
L3	28.0
L4	31.0
L5	29.0
L6	32.0
L7	30.0

TABLE A-I

TUNABLE IF AMPLIFIER DC VOLTAGE CHART

Tube	Tube Type	Pin 1	2	3	4	5	6	7
V1	6J6	150	144			0	2	2.6
V2	6CB6	-2.2	0.38			113	150	0.38
V3	6CB6	-2.0	0.34			138	150	0.34
V4	6CB6	-2.0	0.44			134	150	0.44
V5	6CB6	0	1.9			103	150	1.9
V6	6AN5	0	9.6			150	150	9.6

Note: All readings taken with MANUAL GAIN control set to -2 volts at test point 10.

TABLE A-II

TUNABLE IF AMPLIFIER RESISTANCE CHART

Tube	Tube Type	Pin 1	2	3	4	5	6	7
V1						51	4920	220
V2			47					47
V3			47					47
V4			47					47
V5		0	180					180
V6		0	620					620

Note: All readings given in ohms with respect to ground.

TABLE A-III

LIST OF REPLACEABLE PARTS

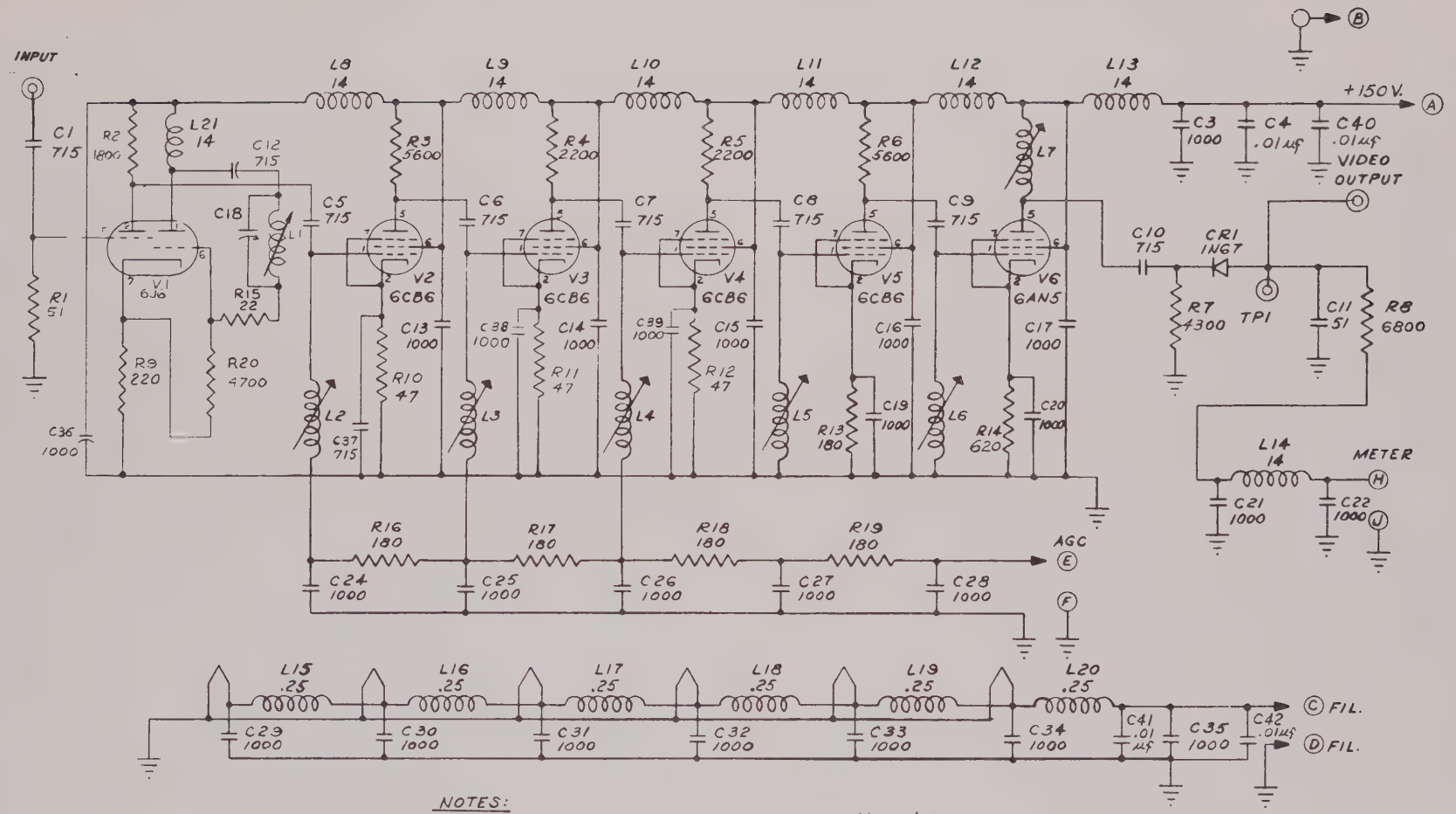
Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
C1	Capacitor, 715 μμf	Type 331 Hi-K	Erie
C3	Capacitor, 1000 μμf	S-114885	AIL
C4	Capacitor, 0.01 μf	811-0.01	Erie
C5	Same as C1		
through C10			
C11	Capacitor, 51 μf	N750K	Erie
C12	Same as C1		
C13	Same as C3		
through C17			
C18	Capacitor, variable, 50 μμf	MAPC-50-B	Hammar-lund
C19	Same as C3		
through C22			
C24	Same as C3		
through C39			
C40	Same as C4		
through C42			
R1	Resistor, composition, 51 ohms ±5%, 1/2 w		Allen-Bradley
R2	Resistor, composition, 1800 ohms ±5%, 1/2 w		Allen-Bradley
R3	Resistor, composition, 5600 ohms ±5%, 1/2 w		Allen-Bradley
R4	Resistor, composition, 2200 ohms ±5%, 1/2 w		Allen-Bradley
R5	Same as R4		
R6	Same as R3		
R7	Resistor, composition, 4300 ohms ±5%, 1/2 w		Allen-Bradley
R8	Resistor, composition, 6800 ohms ±5%, 1/2 w		Allen-Bradley

TABLE A-III (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
R9	Resistor, composition, 220 ohms ±5%, 1/2 w		Allen-Bradley
R10	Resistor, composition, 47 ohms ±5%, 1/2 w		Allen-Bradley
R11	Same as R10		
R12	Same as R10		
R13	Resistor, composition, 180 ohms ±5%, 1/2 w		Allen-Bradley
R14	Resistor, composition, 620 ohms ±5%, 1/2 w		Allen-Bradley
R15	Resistor, composition, 22 ohms ±5%, 1/2 w		Allen-Bradley
R16 through R19	Same as R13		
R20	Resistor, composition, 4700 ohms ±5% 1/2 w		Allen-Bradley
L1	Inductor	114847	AIL
L2	Inductor	112241	AIL
L3	Inductor	113333	AIL
L4	Sames as L2		
L5	Same as L3		
L6	Inductor	112239	AIL
L7	Inductor	112240	AIL
L8	Choke	14 μh yellow dot	Jeffers
L9 through L14	Same as L8		
L15	Choke	0.25 μh red dot	Jeffers
L16 through L20	Same as L15		
L21	Same as L8		

TABLE A-III (cont)

Reference Symbol	Name of Part and Description	Designation or Std Type	Mfr
V1	Tube, electron	6J6	RCA
V2	Tube, electron	6CB6	RCA
V3 through V5	Same as V2		
V6	Tube, electron	6AN5	Raytheon
CR1	Crystal diode	1N67	Raytheon



NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, ± 5% AND ALL CAPACITOR VALUES ARE IN UUF, ± 20% AND ALL COIL VALUES ARE IN UH UNLESS OTHERWISE SPECIFIED.

COIL NO.	A.I.L. DWG. NO.	TUNING Mc
L1	114847	70 To 150
L2	112241	30
L3	113333	28
L4	112241	31
L5	113333	29
L6	112239	32
L7	112240	30

FIGURE A-1. IF CONVERTER 07404, SCHEMATIC DIAGRAM

APPENDIX B

INCREASED FREQUENCY RANGE OF TYPE 07404 TUNABLE ANFI

In the frequency range from 40 to 180 Mc, the Type 07404 Tunable Automatic Noise-Figure Indicator has an input sensitivity of better than 100 μv. A recent investigation indicates that the Type 07404 ANFI will operate satisfactorily to 470 Mc at reduced sensitivity by making use of harmonics of the local oscillator in the mixing process.

For operation from 180 to 330 Mc, an input signal level of at least 400 μv is required. In the frequency range from 330 to 470 Mc, the input signal level must be at least 900 μv.

For frequencies in the range of 40 to 470 Mc, it is necessary to tune the IF strip of the Type 74 as follows:

1. Connect a CW output from the device under test to the IF input of the Type 07404 ANFI.
2. Press the MANUAL OFF and 2ND DET pushbuttons of the ANFI.
3. Adjust the meter to any convenient reading, using the MANUAL GAIN control on the ANFI.
4. Insert a tuning tool into the hole marked FREQ. ADJ., and tune for maximum deflection of the meter.
5. To ensure that the noise voltage of the device under test is of sufficient magnitude to lock the AGC in the ANFI, press the AUTO NF ON and 2ND DET pushbuttons. The meter should read 0.5 ma (full scale) to ensure proper operation.
6. To read noise figure, press the AUTO NF ON pushbutton and either the 0-23 DB or 23-36 DB pushbuttons.